

Dive Safety

- You are part of a citizen's group evaluating the safety of a high school athletic program. To help judge the diving program you would like to know how fast a diver hits the water in the most complicated dive. The coach has his best diver perform for your group. The diver, after jumping from the high board, moves through the air with a constant acceleration of 9.8 m/s^2 . Later in the dive, he passes near a lower diving board which is 3.0 m above the water. With your trusty stop watch, you determine that it took 0.20 seconds to enter the water from the time the diver passed the lower board. How fast was he going when he hit the water?



Lesson #12

Topic: Gravitational Acceleration

Objectives: (After this class I will be able to)

1. Describe the difference between falling objects and regularly accelerating objects.
2. Explain what factors affect the acceleration of a falling object.

Project: Toss a ball in the air and describe its acceleration. (How does velocity change over time?)

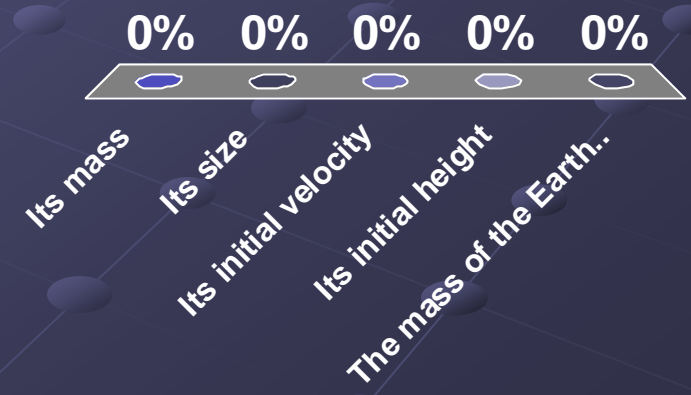
Assignments: Section 3-2 & 3-3 quizzes due tomorrow
"Vertical Acceleration" due Friday
Acceleration Quiz on Friday

Acceleration due to Gravity:

- All objects will fall towards the center of the earth with a constant acceleration.
- The rate in which they accelerate is completely independent of size, shape, height, mass, or initial velocity (despite direction)
- This constant rate is called g.
- $g = -10 \text{ m/s}^2$
- g **never** equals zero.

The acceleration of a falling object depends on...

1. Its mass
2. Its size
3. Its initial velocity
4. Its initial height
5. The mass of the Earth.. Duh!



Positive and Negative Direction

- **Vector:** magnitude with direction

Ex. Displacement, Velocity, Acceleration

- Direction is represented with positive and negative values.
- Upward direction is positive
- Downward direction is negative

Example: (write all givens)

A ball is tossed 3.2 meters into the air with an initial velocity of 8m/s.

Positive and Negative Direction

Example: (write all givens)

A boy throws a water balloon out of a tree house towards the ground with a velocity of 3m/s and hits the person standing 6m below him.

Problem Solving with gravity

We can still use all of our kinematics equations for falling objects.

Except now **$a = g$**

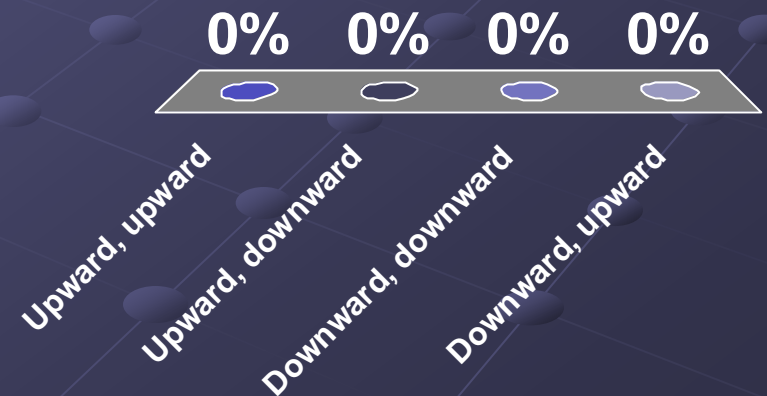
$$v_f = v_i + gt$$

$$d = v_i t + \frac{1}{2} gt^2$$

$$v_f^2 = v_i^2 + 2gd$$

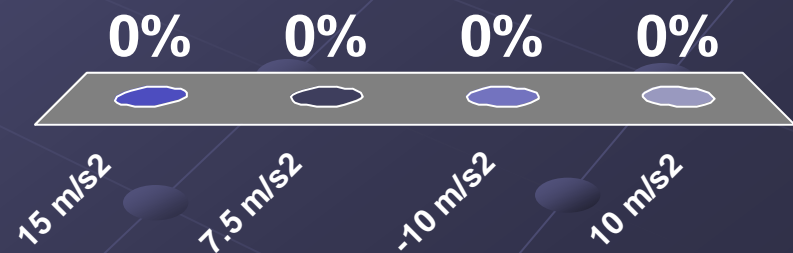
A ball is thrown upward. On the way up it is accelerating _____. On the way down it is accelerating _____.

1. Upward, upward
2. Upward, downward
3. Downward, downward
4. Downward, upward



What is the acceleration of a ball tossed straight into the air with an initial velocity of 15m/s?

1. 15 m/s^2
2. 7.5 m/s^2
3. -10 m/s^2
4. 10 m/s^2



Project

Reaction Time:

Pick a partner and drop a ruler through their hand with their fingertips even with the 0cm mark. Then use the distance that the ruler fell to determine their reaction time.

Remember: Write down your unknown, givens, original equation, and algebra before solving.

Practice Problems

1. A geyser in Yellowstone national park is capable of shooting hot water up from the ground with a speed of 48m/s . How high can this geyser shoot?

Practice Problems

2. A bird in its nest has a worm in its mouth and while trying to drop the worm to its baby, it misses and the worm drops to the ground in 1.5 seconds. How high is the nest?

Practice Problems

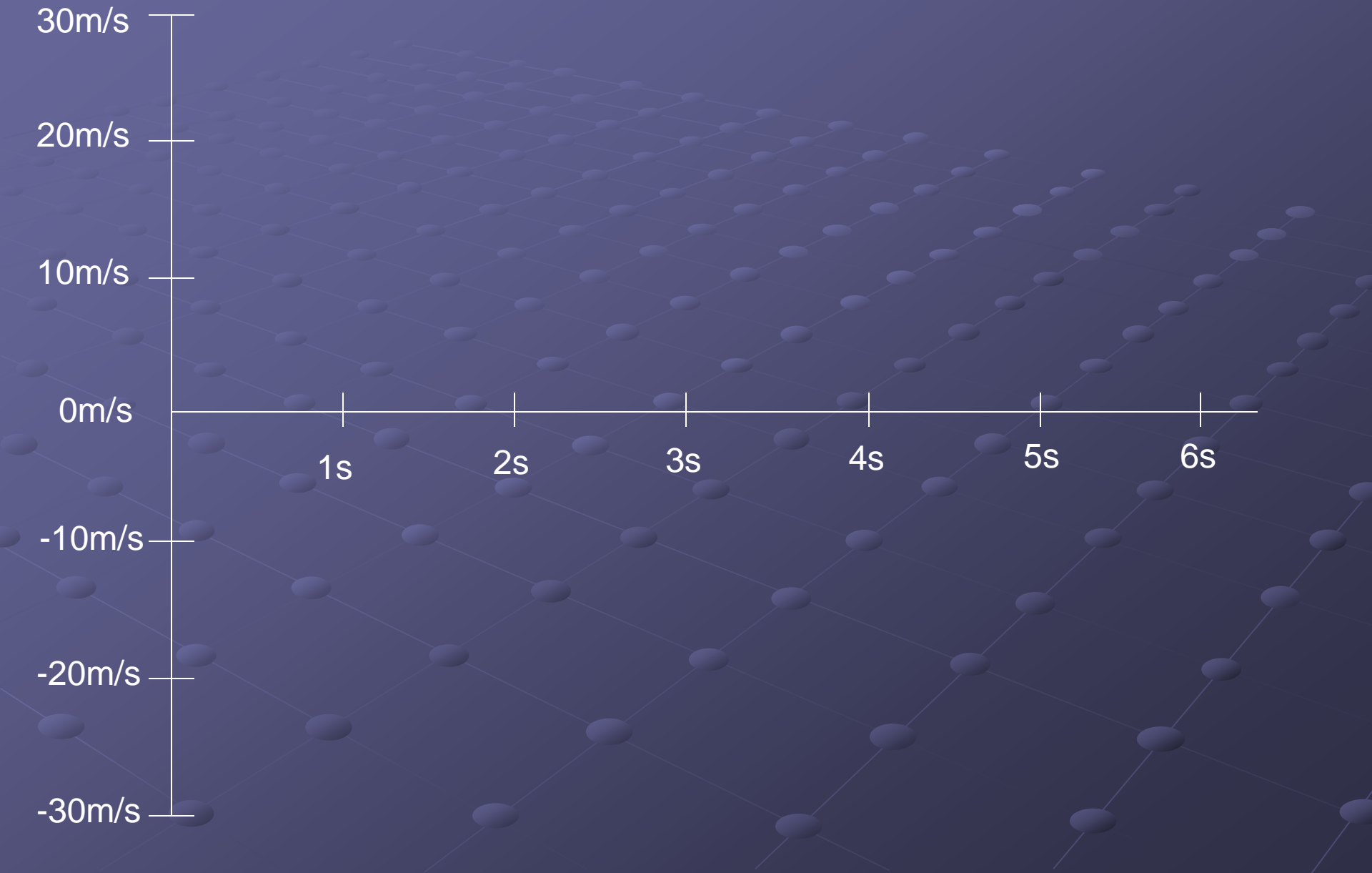
3. Why is it a sure bet that a 15.5 cm dollar bill cannot be caught by your friend if his reaction time is 0.2 seconds and the bill is dropped when the bottom edge of the bill is even with the tips of his fingers?

Critical Thinking Problem

A ball is tossed straight upward into the air. It reaches a maximum height of 45m before falling back down.

- How long was the ball in the air?
- What was its velocity when it left the person's hand?
- What was its velocity when it fell back into the person's hand?
- Create a velocity vs. time graph of the ball's motion.

Critical Thinking Problem

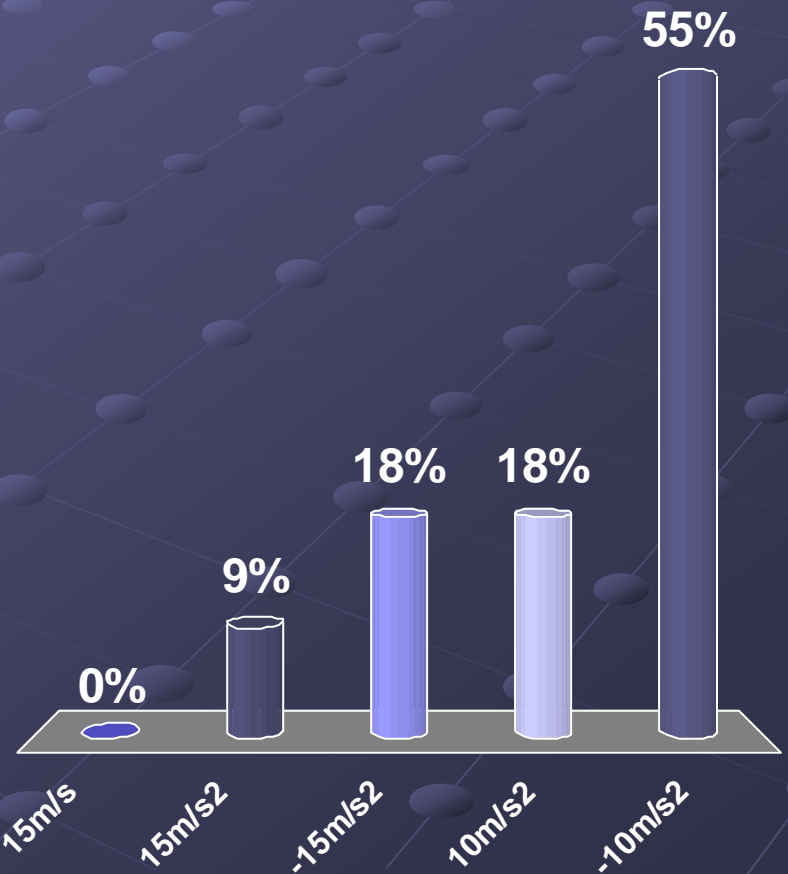


Free fall acceleration

- Assignment:
- p85 Standardize Test Practice #1 – 7
- Get to the chopper quiz

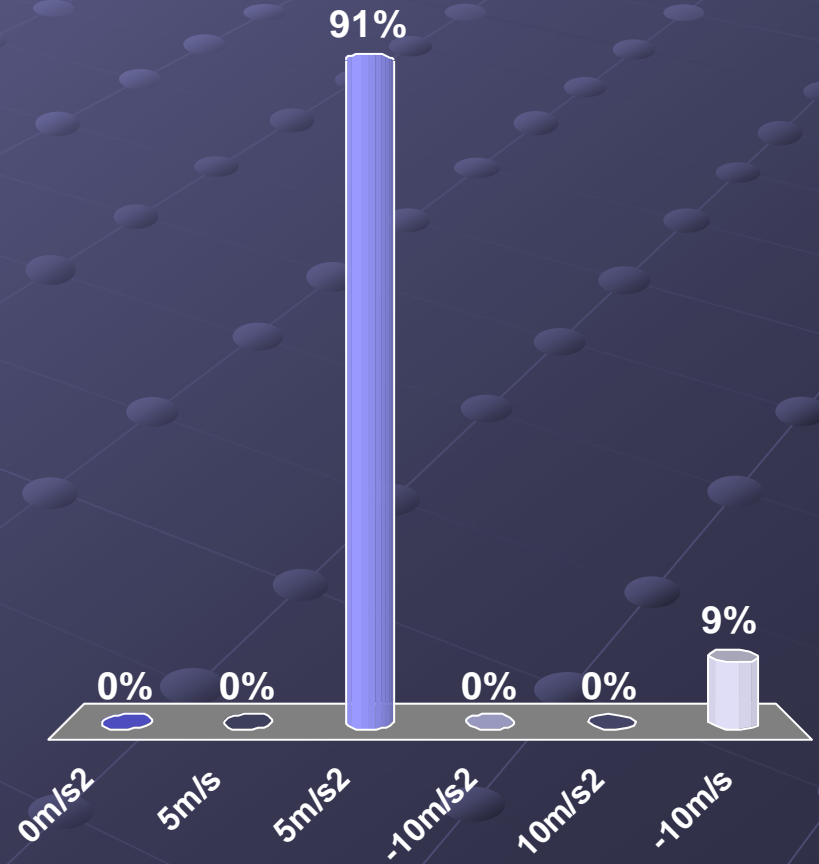
A baseball is thrown vertically into the air with an initial speed of 30m/s . After 2 seconds the ball's acceleration is...

1. 15m/s
2. 15m/s^2
3. -15m/s^2
4. 10m/s^2
5. -10m/s^2



A race car starts from rest. 5 seconds later it has achieved a velocity of 25m/s. The acceleration of the car is...

1. 0m/s^2
2. 5m/s
3. 5m/s^2
4. -10m/s^2
5. 10m/s^2
6. -10m/s

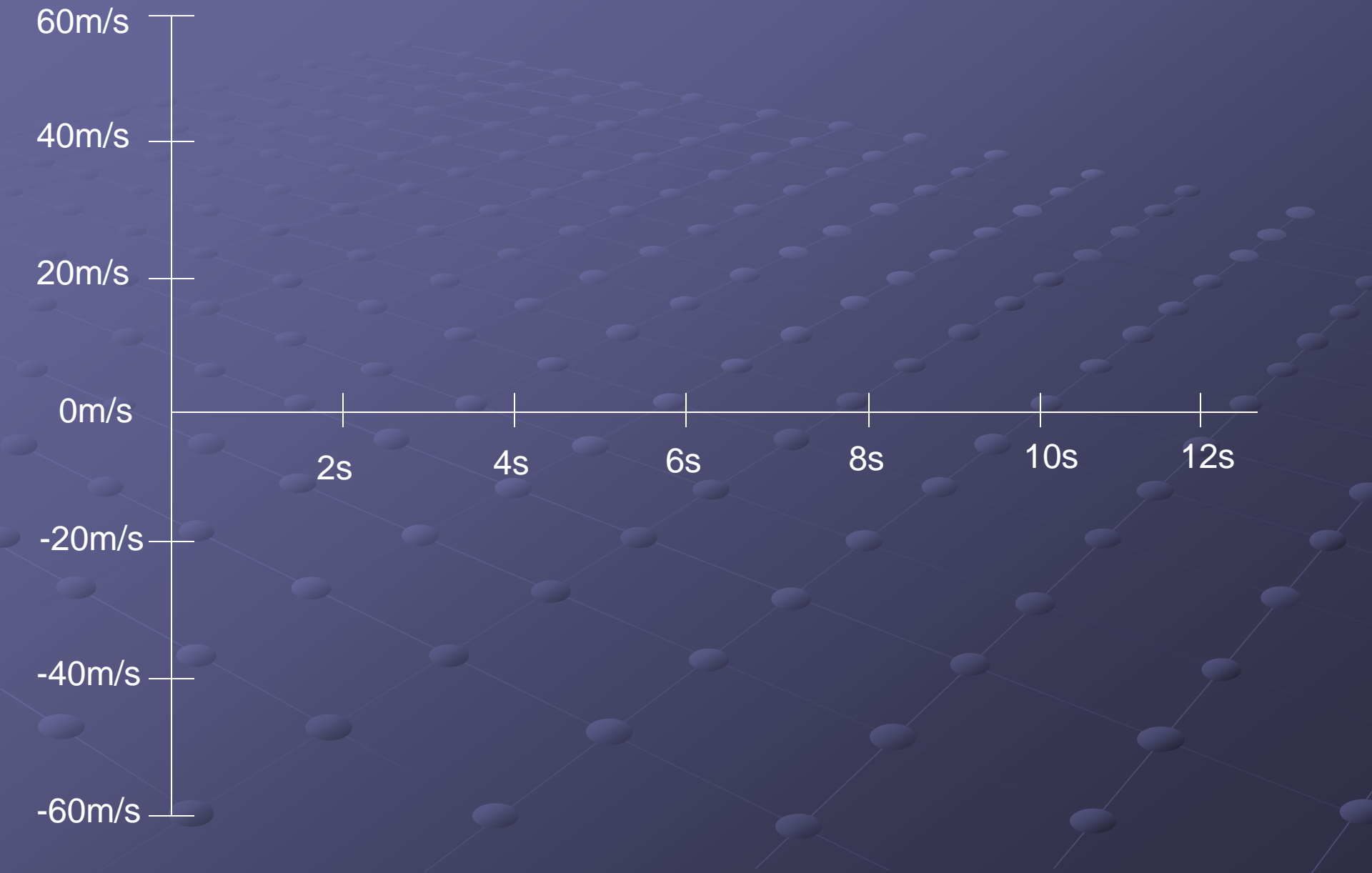


Critical Thinking Problems

A bullet is fired vertically into the air. It remains in the air for 12 seconds before falling back to the ground.

- How high did the bullet go into the air?
- With what velocity did it leave the gun?
- With what velocity did it return to ground?
- Create a velocity vs. time graph of the bullet's motion

Critical Thinking Problem



Old Stuff Bonus (2pts)

Two trains are traveling towards one another and each train is traveling at 10km/h. When the trains are 20 km apart, a bee begins flying from one train to the other at a steady speed of 30km/h. When it gets to the one train it quickly turns around and flies back to the other train. It keeps doing this over and over until the trains meet and SQUISH!

How many kilometers did the bee travel in its total back-and-forth trips?

